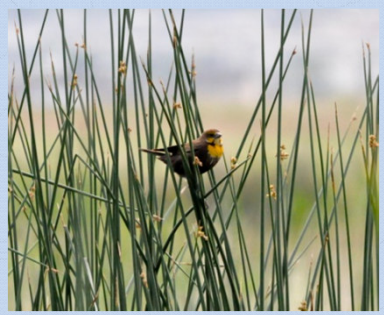
Developing a Definition of Health for the Great Salt Lake



Great Salt Lake Advisory Council
November 2, 2011

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SWCA Environmental Consultants, Inc.

Presentation Overview

Conservation Action Planning Framework Review
Workshop 1 (October 14, 2011)
Development of KEAs, Indicators, and Ratings
Workshop 2 'Strawperson'

Conservation Action Planning Framework Review

- CAP is a peer-reviewed, widely applied method for planning, implementing, & measuring conservation success
- CAP framework identifies:
  - Ecological targets (ecological communities)
  - Nested targets (species or guilds)
  - Key ecological attributes (critical to targets/nested targets)
  - Measurable indicators
  - Acceptable range of variation of the indicator values
  - Current stresses
  - Current health

Conservation Action Planning Framework Review

Steps in CAP Approach	Work Elements
• Identify Science Advisory Panel	• Scoping & external advisory panel
• Define conservation targets/nested targets	• Workshop 1
• Define KEAs, indicators, and ratings	• Conduct Workshop 2
• Identify stresses & analyze current condition	• Conduct Workshop 3
• Establish measures	• Outline monitoring program

Workshop 1

- Provided Science Panel with initial set of targets, target descriptions, and nested targets for revisions, additions, or deletions
- Panel narrowed down the set to 8 Targets
- Panel determined that assessment of health should be stratified by the 4 bays
- Panel worked through KEAs and indicators for 1 target ('strawperson')

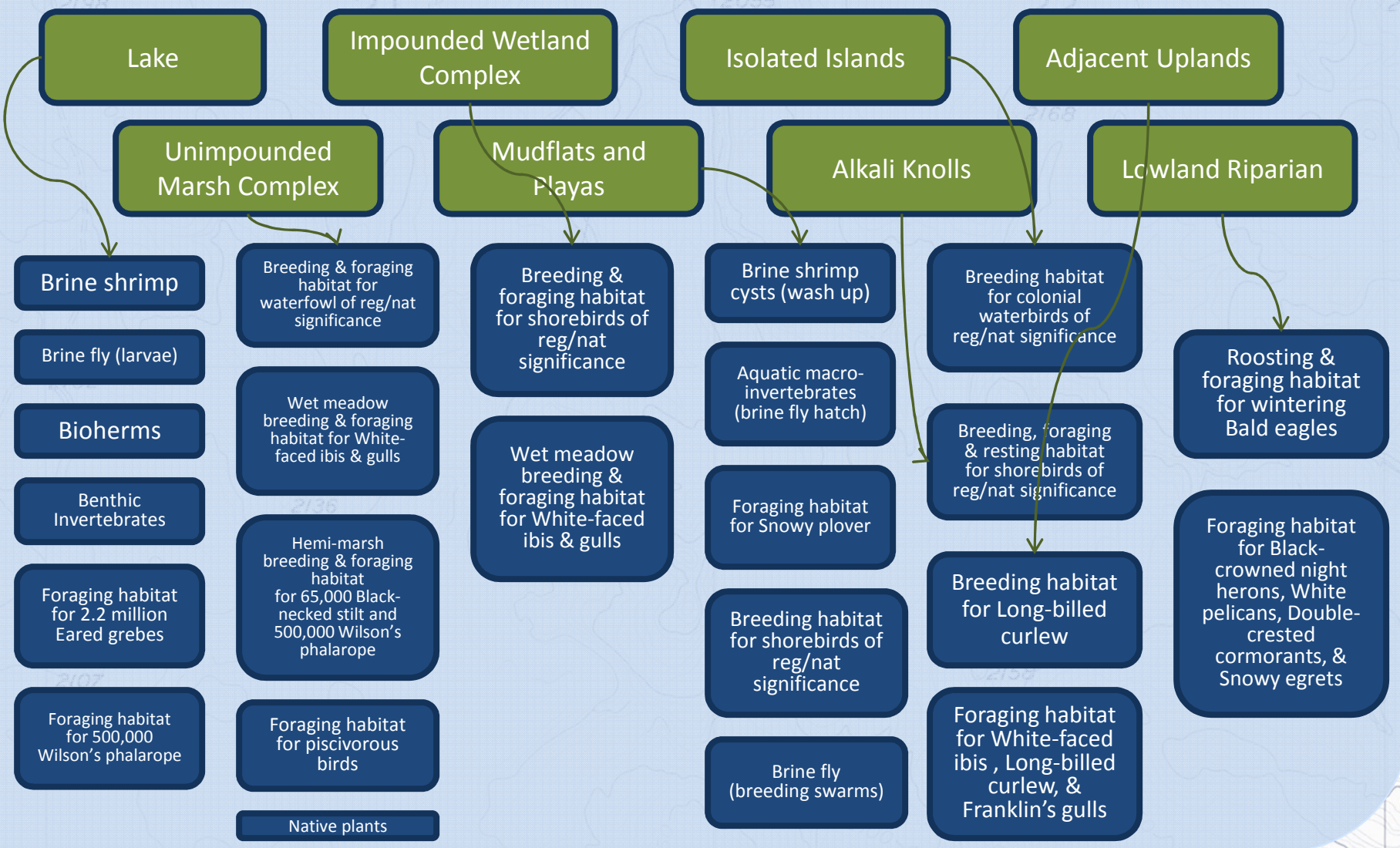
Workshop 1: GSL Targets

1. Lake (open water)
2. Unimpounded marsh complex
3. Impounded wetland complex
4. Mudflats and playas
5. Isolated island habitat for breeding birds
6. Alkali knolls/flats/bottoms
7. Adjoining uplands (grasslands/shrublands/agricultural lands)
8. Lowland riparian

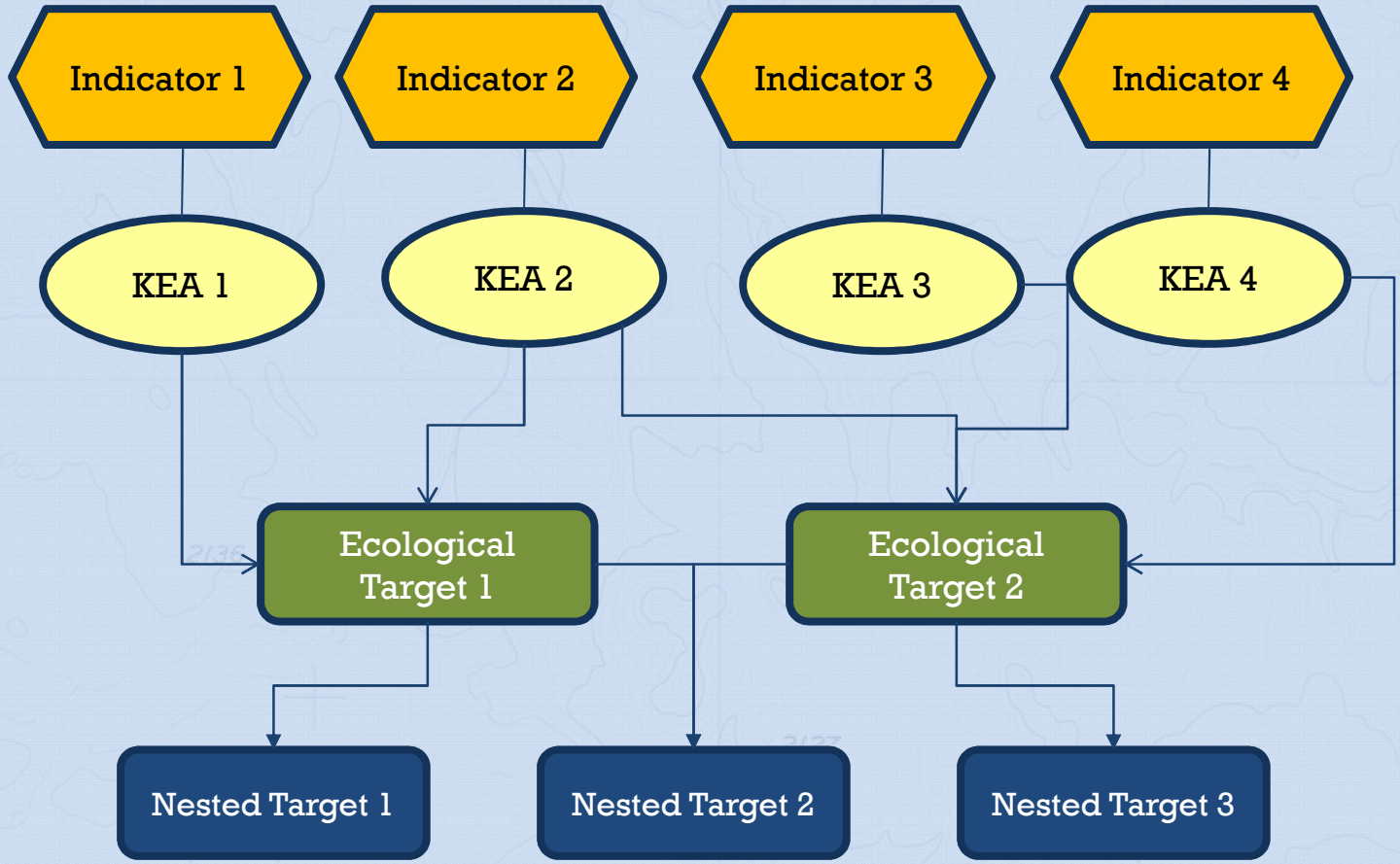
Workshop 1: Target Description Example: Lake

"Lake habitat represents open water from the shoreline and includes the entire water column, including shallow and deep brine layers, benthic habitat, and the sediments on the lake bottom. Lake habitat does not include waters within the shoreline of the lake that are constrained by impoundments. The depth and spatial extent of lake habitat varies with seasonal and long-term fluctuations in climate and changes to watershed hydrology. Stratification occurs throughout the lake in association with variations in temperature and salinity."

Workshop 1: Nested Targets



Workshop 2:
Development of KEAs, Indicators, & Ratings



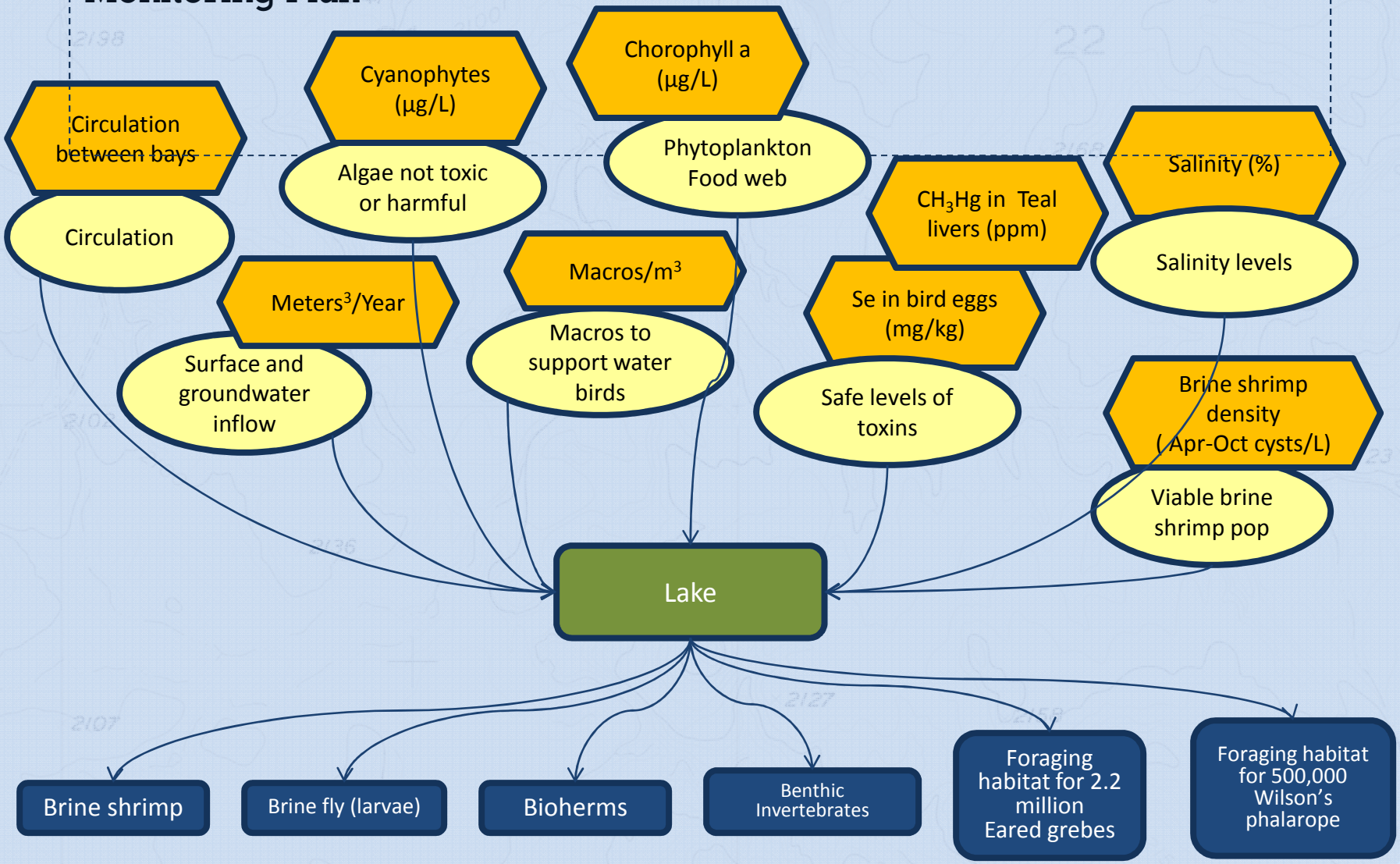
Workshop 2: Development of KEAs, Indicators, & Ratings

- Workshop 1 'strawperson' of KEAs for Lake (Target #1)
- SWCA team developed full set of KEAs, indicators, & ratings for Science Panel review

Workshop 2: Development of KEAs, Indicators, & Ratings

#	Conservation Targets	Category	Key Attribute	Indicator
1	Lake	Landscape Context	Circulation	Circulation of water and constituents between bays
			Surface and groundwater inflow	Water inflow (m3/yr)
		Condition	Algal species not toxic or harmful to birds or brine shrimp	Concentration of cyanophytes (µg/L)
			Macroinvertebrate population sufficient to support water birds such as Wilson's phalarope	Density of invertebrates in the water column including copepods, corixids, and brine flies (number/m^3)
			Phytoplankton supportive of food web	Chlorophyll a (µg/L) when brine shrimp are present during brine shrimp season (March - November)
			Safe levels of toxins	Concentration of methylmercury in Cinnamon Teal liver
			Safe levels of toxins	Concentration of selenium in bird eggs
			Salinity levels supportive of native biota	Salinity (%)
			Viable brine shrimp population	Brine shrimp density April - October (cysts/L)

CAP Targets, Attributes, and Indicators



Workshop 2:
Development of KEAs, Indicators, & Ratings

- 'Strawperson' of KEAs, Indicators, and Ratings for all 8 Targets sent to Science Panel
- Panel comments have been received and are being incorporated into the CAP Workbook for review in Friday, November 4th Workshop
- Workshop 3 product will be revised set of KEAs, Indicators, and Ratings based on panel input
- Review of Indicator Ratings…that will lead to final GSL Health Definition product

Indicator Ratings

Definition of health

- ***Very good***: functioning at an ecologically desirable status and requires little if any human intervention
- ***Good***: functioning within its range of acceptable variation; it may require some human intervention
- ***Fair***: functioning outside of its range of acceptable variation and requires human intervention to restore a "Good" condition
- ***Poor***: allowing the key attribute to persist in this condition would make restoration of the target practically impossible

Key Attribute	Indicator	Poor	Fair	Good	Very Good
Circulation	Circulation of water and constituents betwen bays	Circulation that prevents nutrient movement between bays and results in semi-permanent establishment of a deep brine layer		Circulation that facilitates movement of nutrients, salts, and brine shrimp and minimizes the formation of deep brine layer	Circulation that provides nutrients across the lake and prevents the formation of a deep brine layer
Surface and groundwater inflow	Water inflow (m3/yr)	Inflow allows lake level to drop below 4,192		Inflow sufficient to maintain lake level of 4,195	
Algal species not toxic or harmful to birds or brine shrimp	Concentration of cyanophytes (ug/L)	>100,000	20,000 - 100,000	less than 20,000	None
Macroinvertebrate populatoin sufficient to support water birds such as Wilson's phalarope	Density of invertebrates in the water column including copepods, corixids, and brine flies (#/m3)				
Phytoplankton supportive of food web	Chlorophyll a (ug/L) when brine shrimp are present during brine shrimp season (March - November)			X to support brine shrimp density of 100 cysts/liter	
Safe levels of toxins	Concentration of methylmercury in Cinnamon Teal liver	more than 0.89 ppm			
Safe levels of toxins	Concentration of selenium in bird eggs	12.5 mg/ kg celenium	between 12.5 and 6.4 mg/ kg	between 6.4 and 5 mg/kg	less than 5 mg per kg
Salinity levels supportive of native biota	Salinity (%)	Less than 5% or greater than 28%	5 - 10% or 20 to 28%	10 - 14% or 17 - 20%	14% - 17%
Viable brine shrimp population	Brine shrimp density April - October (cysts per liter)	<21 cysts/liter	21 - 99 cysts/liter	>100 cysts/liter	

Science Advisory Panel

Researcher	Affiliation	Category				Abiotic					Ecology											
		Academia	Federal Agencies	State Agencies	Private	Geochemistry	Limnology	Salt balance	Nutrient dynamics	Hydrology	Shorebirds	Waterfowl	Brine shrimp	Aquatic	Fish	Impounded wetlands	Wetlands	Microbial	Population dynamics	Algae	Invasive plants
Gary Belovsky	University of Notre Dame	x							x				x						x	x	
Dave Naftz	USGS		x			x	x		x	x											
John Cavitt	Weber State University	x									x	x									
Wayne Wurtsbaugh	Utah State University	x					x		x					x	x					x	
Theron Miller	Jordan River/Farmington Bay Water Quality Council				x	x	x									x				x	x
Bonnie Baxter	Westminster College	x																x		x	
Heidi Hoven	IWSciences				x											x	x				x
Wally Gwynn	Independent consultant				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Craig Miller	Division of Water Resources			x				x		x											